

Small Satellite Attitude Determination and Control

Completed Technology Project (2011 - 2015)



Project Introduction

The proposed effort aims to develop technologies for high-precision pointing in small satellites to enable detection of Earth-sized exoplanets transiting nearby, Sun-like stars. This overall goal of precision pointing is broken down into two distinct research objectives. The first is to develop staged control algorithms with narrowband disturbance rejection to combine the benefits of systematic staged control synthesis with high attenuation of tonal disturbances arising from sources such as reaction wheels. While both topics have been developed independently, they have not been combined in a single control system. The second research objective is to develop estimation techniques to develop improved estimation techniques for staged control that estimates high-frequency disturbances with the use of low-cost sensors. These research objectives will be carried out by first developing a simulation, based on hardware component testing. The developed algorithms can be tested and tuned rapidly in this simulation. In addition, trade studies will be performed with this simulation to inform the final design of the satellite. To demonstrate the algorithms and validate the simulation results, hardware-in-the-loop testbeds will be fabricated. To streamline this process, embeddable code will be generated directly from the simulation. The hardware tests will culminate in a full three-degree-of-freedom test of the staged control system. This proposed effort directly supports the NASA space technology goal to create "innovative new space technologies for our nation's science, exploration, and economic future." High-precision pointing in small satellites is also one of NASA's goals for Game Changing Technology. In addition, the mission of finding Earth-like planets is aligned one of NASA's goals in the 2006-2016 Strategic Plan.

Anticipated Benefits

This proposed effort directly supports the NASA space technology goal to create "innovative new space technologies for our nation's science, exploration, and economic future." High-precision pointing in small satellites is also one of NASA's goals for Game Changing Technology.



Project Image Small Satellite
Attitude Determination and
Control

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission
Directorate (STMD)

Responsible Program:

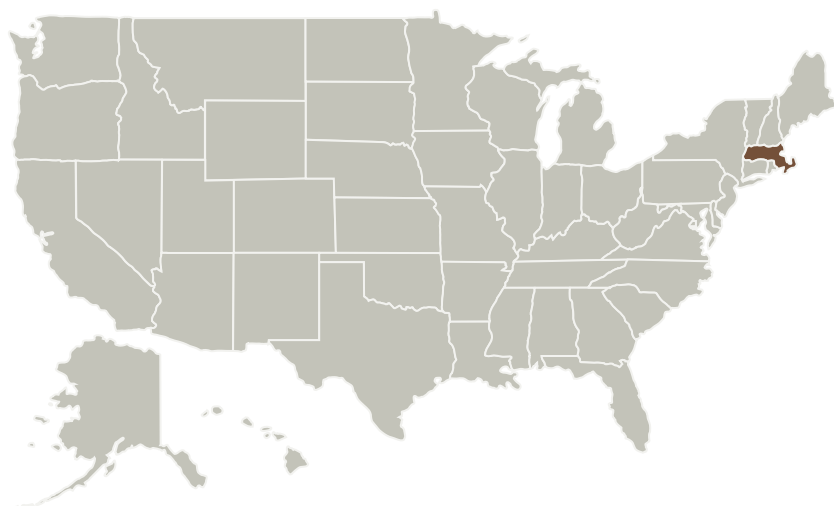
Space Technology Research
Grants

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Primary U.S. Work Locations and Key Partners



Primary U.S. Work Locations

Massachusetts

Images



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Project Image Small Satellite
Attitude Determination and Control
(<https://techport.nasa.gov/image/1824>)

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

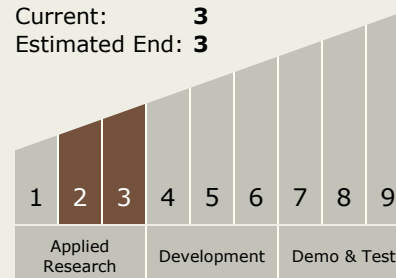
David N Miller

Co-Investigator:

Christopher M Pong

Technology Maturity (TRL)

Start: 2
Current: 3
Estimated End: 3



Technology Areas

Primary:

- TX04 Robotic Systems
 - TX04.5 Autonomous Rendezvous and Docking
 - TX04.5.7 Modeling, Simulation, Analysis, and Test of Rendezvous, Proximity Operations, and Capture

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Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>